SANITARY WORK ON THE ISTHMUS OF PANAMA DURING THE LAST THREE YEARS.

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My wish in this article is to give a general description of the sanitary conditions which existed on the Isthmus at the time the United States assumed control; to explain the methods which have been taken to improve these conditions, and to point out the results attained by these methods.

The Isthmus of Panama at the point where the proposed canal is being constructed extends from east to west. The canal course runs nearly north and south. At this point has been located the principal route of crossing since the discovery of America. The Spaniards, however, built a very good causeway for pack animals from the old town of Panama to Porto Bello. This causeway was paved with cobblestones and is still in a fair state of preservation. The old town of Panama is some six or seven miles east of the present town of that name, and Porto Bello is about thirty miles east of Colon. The advantages of the Chagres as a means of getting across the Isthmus were soon appreciated and travel was gradually transferred to the Chagres river until about the year 1670, when Morgan, the famous English buccaneer, captured

the old city of Panama. After this the old overland trail to Porto Bello was abandoned, the city of Panama changed to its present location, and the Chagres almost exclusively used as a route for crossing the Isthmus. The Chagres empties into the Caribbean some ten miles west of the present town of Colon. Porto Bello, which has an excellent harbor, remained the port on the north coast. All vessels crossing the ocean from Europe were unloaded at Porto Bello, the cargoes transshipped in smaller vessels to the mouth of the Chagres, where they were loaded into small dugouts and carried up the Chagres to the south some forty miles to the point where the Chagres changes its course. From this point they were carried overland on pack animals to the present city of Panama. A paved road was built from this point, Las Cruces, to the present city of Panama. This formed the main route of crossing up to the time of the building of the Panama Railroad. A large portion of the population which went from the eastern states and from all parts of the civilized world to California in 1849 and the immediately succeeding years, crossed by this route. In 1855 the railroad was thrown open to traffic. This road practically followed the former routes of crossing, went south up the Chagres to the point where the Chagres turned. From this point it followed up the valley of one of the large tributaries, the Obispo, until it crossed the divide, then followed the valley of the Rio Grande, which empties into the Pacific near Panama.

Colon is not situated at the mouth of the Chagres river. The railroad strikes the Chagres at Gatun, some ten miles from its mouth. The canal route practically follows the line of the railroad from Colon on the north to Panama on the south.

Some thirty years after the completion of the

railroad a French company under the leadership of Monsieur De Lesseps commenced building a sea-level canal between Colon and Panama, following the route of the railroad. This company, after some seven years' work, and having done considerable excavation, failed.

The United States has acquired a strip of territory ten miles wide, with the canal as a central line, extending entirely across the Isthmus from Colon on the north to Panama on the south. The country is low and swampy for the first fifteen miles; the rest of the route, some thirty odd miles, is through a mountainous country. The temperature all the year round in this territory is tropical, varying very little between January and July. Conditions as to warmth are thus such that the mosquito will breed prolifically all the year round. Over the mountainous part of the route the peaks are from 100 to 1,000 feet in height, nowhere being high enough to in any way inhibit from a temperature standpoint the breeding of mosquitos. Water is abundant everywhere, in the mountainous section little streams coming from every ravine, forming ideal places for the anopheles, and in the swampy section stagnant pools of fresh water are on every hand. The towns of Panama and Colon were formerly dependent entirely for their water supply upon stored rain water. The dry season, when very little rain falls, lasts for some four months, and rain water had to be stored for use during this dry season. The large number of tanks and receptacles containing rain water thus made ideal breeding places for the yellow fever mosquito.

Now for four hundred years we have had a constant stream of unacclimated persons of the white race crossing this Isthmus. This constant stream infected the territory with both malaria and yellow

fever and kept up the infection to a very much higher degree than in the neighboring tropical countries which did not have this stream of whites constantly in their territory. The travelers in a great many cases were dignitaries of importance, merchants, and people of wealth. Everybody who traveled from the west coasts of North and South America, in general, crossed at Panama, so that many important personages sickened or died at Panama. For this reason it has acquired a reputation for bad health which is second to that of no other locality in the world.

The French began the construction of a canal in this same territory in the year 1881 and kept on the Isthmus some 19,000 laborers, 2,200 of whom were whites. This large body of men remained here some seven years working on the canal. The infection of both yellow fever and malaria being already present and other conditions being favorable, this large access of unacclimated people greatly increased the ordinary mortality, and as the project interested all the world the health conditions became widely known and gave to the Isthmus the very bad reputation it had when we came down here. The locality, however, is not naturally unhealthful. On the whole, it is a pretty and attractive country, with pleasant climatic conditions. Conditions as to temperature, rainfall, and local water supply happen to be favorable to the development of the stegomyia and anopheles mosquito, and then for four hundred years unacclimated whites were introduced in a steady stream, sometimes in very large numbers, such as during the construction of the railroad, and of the canal under the French, but I am inclined to think that such a thing would occur anywhere else in the world where the altitude was less than 2,000 feet, the minimum temperature not

less than 60° Fahrenheit, and the rainfall more than thirty inches, provided the unacclimated whites had been brought there in the same way.

This, in general, had been the history of the Isthmus when the United States acquired possession in 1904. In April of 1904, just before the property was transferred to the United States, I was one of a party of American officials who spent a month on the Isthmus looking carefully into the then existing conditions. At this time there were some 40,000 people in the territory at present under our sanitary control, about 6,000 in Colon, about 24,000 in the city of Panama, and some 10,000 scattered in twenty-two villages along the line of the railroad. The principal business of the community was that connected with the railroad. The French were employing about a thousand men in digging on the canal, but they apparently were doing this only to hold their franchise. Business of all kinds was practically dead and the whole community was very poor and financially much depressed. The health conditions were about those common to the neighboring tropical countries. A case of yellow fever occurred now and then and malaria was pretty general. Two years before Panama had suffered rather severely from yellow fever on account of the introduction of a considerable body of troops from the interior of Colombia, but by the time we arrived this had quieted down to a few scattered cases. Colon had no water supply or sewage system, was built in a swamp, and every house had several water barrels for the collection and storing of rain water. Panama, though built on high, well-drained ground, was the same as Colon with regard to collecting of rain water. The French had some 2,000 buildings for the accommodation of their working force, scattered at various points along the line of the canal

between Colon and Panama. The jungle everywhere had grown up to the railroad track, and on the whole the country presented a desolate scene of dilapidation, business depression, and financial failure. After considering the matter, it was clear that yellow fever was the disease that would interfere particularly with our success, and to which most attention would have to be given, and that the canal would probably not be completed unless we could protect our force from this disease. Yellow fever infection was evidently in Panama, and as our unacclimated force of whites was introduced from the United States I knew it would affect them just as it did the whites among the French force, unless we took measures to prevent it. The stegomyia mosquitos were everywhere in abundance, their breeding places were to be found on every hand, and the temperature was such all the year round that they could breed uninterruptedly. Malaria I also found everywhere. If this were not checked it would cause considerable mortality and a still larger rate of inefficiency among our forces, but even if unchecked would not have the moral effect that yellow fever would have. I know of no disease that causes the panic among the whites that yellow fever does. I found there was some dysentery, but not a great deal, considerable beriberi, principally located in the cities of Panama and Colon, and a great deal of Asiatic plague in the cities of Peru to the south of us. I also found considerable ankylostomiasis among the population, and these diseases might have to be considered in bringing a large force to the Isthmus. With the assistance of Dr. John W. Ross, U.S.N., and Dr. Louis A. LaGarde, U.S.A., I drew up plans for meeting these conditions. Major C. E. Gillette of the Engineering Corps of the Army drew up plans for water supplies

and sewage systems for the cities of Colon and Panama. We introduced systems based, so far as they applied locally, on the plan we followed in Havana. We established health departments in each town, with functions in general similar to those of our health departments at home, such as sweeping the streets, disposing of garbage, and such general sanitary work as is done in a city of the same size in the United States, but our energies were principally concentrated upon the question of yellow fever. For this purpose the towns were divided into small districts, such that an inspector could get around to each house twice a week. This inspector looked after the premises, principally with regard to breeding of stegomyia. On his report a force would be sent to the house to make all water barrels and cisterns mosquito proof. This was done at public expense, and all other collections of water were either gotten rid of or oiled. All unacclimated persons sick with fever were treated as if they were suspected of having yellow fever. Physicians were required to report all such, and in case they had yellow fever they were either removed to a screened ward at the hospital or the houses in which they were sick were carefully screened. After the case was disposed of, the houses occupied, and all contiguous houses, were fumigated for the purpose of killing all infected mosquitos. A record was kept of all the unacclimated people in the city, and houses occupied by such people were visited daily by an inspector, and when he found any such persons sick he reported them at once to the Health Office. In addition to this, in both cities anopheles work was done, ditching, draining, and oiling in the suburbs. The Canal Zone, between Colon and Panama, was divided into some twenty odd districts and a sanitary inspector was placed in charge of each district. His

duties were to attend to the general sanitary work of his district, look out for the proper care of night-soil, disposal of garbage, ditching, and draining for anopheles work, the stegomyia work around houses, isolating and screening for yellow fever, etc.

In order to prevent the introduction of yellow fever and other contagious diseases from the outside a strict quarantine was established at the two ends of the zone, Colon and Panama.

For the care of the sick employees a hospital system was established, but as it was of great importance from a sanitary point of view to get hold of contagious diseases early these hospitals were thrown open to the whole Isthmian population. This scheme has been elaborated for the past three years, until at present we have the Sanitary Department organized into the following divisions: The Hospital Division, the Quarantine Division, the Health Division of Panama, the Health Division of Colon, the Health Division of Bocas del Toro, and the Division of the Chief Sanitary Inspector, which has supervision of health matters along the line of the canal between Panama and Colon.

The Quarantine Division maintains a maritime quarantine at the ports of Ancon, Panama, Colon and Cristobal. This division has been most efficiently organized under the supervision, first, of Dr. Henry R. Carter, and afterwards under Dr. J. C. Perry, both of the Public Health and Marine Hospital Service.

The Hospital Division was organized first by Dr. John W. Ross of the U. S. Navy, who, when he left on account of ill health, was succeeded by Dr. Henry R. Carter. It consists of two principal hospitals at each end of the line, Colon Hospital in the city of Colon, and Ancon Hospital at Panama. Colon Hospital is built on a coral reef, over which the

sea washes freely, and is beautifully located as far as exposure to the breeze is concerned. Ancon Hospital is situated on the side of a mountain just back of Panama, and is most favorably located both as to beauty of view and accessibility to the breeze. We also have a convalescent hospital of some seventy beds, which is located at Taboga Island, twelve miles distant from Panama in Panama Bay. Between Colon and Panama, on the line of the railroad, we have some twenty-five hospitals, having a capacity of from ten to forty beds each. Colon Hospital has 500 beds, and Ancon 700. On account of the expected increase in force, we are at present extending Ancon Hospital with the expectation that by the end of the present year we shall have some 1,200 beds, the idea being to have the two base hospitals equipped with all modern appliances, with a competent nursing force and men more or less specialists in their various branches, so that any class of cases could be well cared for. The twenty-five line hospitals are only intended to care for the patients until they can be moved to the base hospitals, and for such of the seriously sick and injured whom it is thought not advisable to move. Last summer when our sick rate was at its maximum we were able to accommodate in these hospitals some 1,700 patients.

The Health Division of the zone is under the able management of Mr. J. A. LePrince, a sanitary engineer who did similar work in Havana, Cuba. He has under him some twenty-five sanitary inspectors and about one thousand laborers to attend to the ditching, draining, and sanitary work generally of the 40,000 people scattered along the line of the canal between Panama and Colon.

The Health Office of the city of Panama is under Dr. John H. Purnell, who employs some 200 men

in street cleaning, ditching, draining, garbage collecting, and sanitary work in general of the city of Panama.

The Health Office of Colon is under the charge of Dr. E. H. Wheeler, who employs about 200 men in draining, ditching, and brush cutting in the swamps in which Colon is built, and attending to any other matters pertaining to the health work of the city.

As there was some yellow fever last year at Bocas del Toro, the President of the Panaman Republic appointed one of the officials of the Sanitary Department as Health Officer of Bocas. We employ some twenty men at this small port doing general sanitary work there.

This work has so far accomplished very satisfactory results. Yellow fever has apparently been entirely eliminated. We have had only one case on the Isthmus during the last fifteen months. A recent critic of Isthmian sanitary affairs has stated that this is merely accidental; that there have been times in the past when Panama was free from yellow fever for several years in succession, and that we would certainly have an epidemic of yellow fever some time in the near future which would stop the construction of the canal. It is true that Panama has been free from yellow fever for several years in succession at various periods in the past. This is the case in all small tropical cities subject to yellow fever, and it occurs for this reason: For one cause or another the native population, wherever yellow fever exists continuously, becomes immune to yellow fever. This is a well-recognized fact everywhere. Such being the case, it is the non-immunes, or strangers, who keep up the disease. Take a place of 25,000 or 30,000 inhabitants such as Panama, and in ordinary times the strangers who settle in the community are comparatively few. They

soon all have yellow fever and then the disease dies out; but a few strangers continue to come in and in the course of a few years quite a number accumulate. Then when yellow fever is introduced from the outside enough nonimmune material is present to keep the disease going for a time, but if for any reason a large number of strangers come in every year then the epidemic of yellow fever becomes continuous and keeps up as long as the strangers continue to come in. This has been exemplified at pretty much every town where yellow fever has prevailed in the tropics. At Rio de Janeiro yellow fever has prevailed continuously for the last fifty years, due to the large foreign immigration constantly coming into the city. At Havana it was present for considerably over one hundred years continuously from the same cause. At Panama the intermittent condition was well exemplified. In ordinary times they would have yellow fever for two or three years and then be free of it for two or three years, but whenever they had a considerable foreign immigration yellow fever was continuous. Thus yellow fever was continuous all during the construction of the railroad and again to a greater extent during the work on the canal by the old French company. The French, of course, brought over a large number of European employees. During the construction by the old company, from 1881 to 1889, considerable numbers of these European employees came over every year. This continuous influx kept yellow fever going during the whole time of construction by the old French company. In Ancon Hospital alone the old hospital records show that 1,200 deaths occurred from yellow fever during this period, and when it is remembered that these came from a force which at no time exceeded 3,000 men, one can appreciate what a heavy tax it was

upon this force. The French during all these years, from 1881 to 1889, with a white nonimmune force which had as its maximum 3,000 men, did not pass a month in which one or more deaths from yellow fever did not occur in this force. With a nonimmune force four times as large, for we now have over 10,000 whites, if we include women and children, we have passed fifteen months with not a single case of yellow fever. The case which occurred in May, 1906, was in a man not an employee of the Commission. There never has been a time in the whole history of the Isthmus, from the time it was discovered by Columbus up to the present time, when there have been anywhere near as many men subject to yellow fever present on the Isthmus as there are now. The disease was on the Isthmus when we came in April, 1904, and remained with us up to December, 1905. During this time we were constantly increasing our nonimmune population. I therefore feel confident that the same methods which eliminated yellow fever from Havana have accomplished the same results at Panama. I do not believe that our present freedom from yellow fever is in any way accidental. Our work here, I think, is another evidence of the great obligation mankind is under to the Army Board, of which Major Walter Reed was chairman and Lazear and Carroll were members, for establishing the fact that the stegomyia mosquito was the transmitter of yellow fever. Without this knowledge I do not believe we could have done any better than did the French, and, judging from the alarm that was caused by the comparatively mild epidemic which we had among our employees in 1905, I doubt, in case we were having the same amount of yellow fever that the French had, whether we could keep a sufficient force of white employees here to carry on the work. And

even if we could keep white employees here under such circumstances, I doubt whether public sentiment in the United States would allow the canal to be built at such a sacrifice of human life.

In this connection I would like to call attention to the little credit the French white employees get for the heroism which they exhibited in coming to Panama. Every Frenchman who came to Panama knew that he was going to have yellow fever, and he also knew that every second man would die with it. To face such chances took no little courage.

The most useful result of our work, I think, however, as far as the canal work is concerned, is the extent to which malaria is held in check. While yellow fever was the fatal disease to the French, it did not affect their sick rate to a very great extent; that is, if you take their sick report day by day you would find thirty to forty men sick from yellow fever and 400 or 500 sick from malarial fever, so that malaria was causing eight or ten times the financial loss that yellow fever did. Malaria is still with us the principal cause of sickness; I mean we have a good many more men every day sick from malaria than from any other one cause, but our whole sick rate is very small. Last month (March) 1907 our sick in hospitals amounted to less than 20 per 1,000, and our total excused on account of sickness from all causes to about 23 per 1,000; that is, out of every thousand men we had absent on account of sickness in hospitals, their homes, and everywhere, an average every day during the month of twenty-three men. This is as small a rate as we would probably have if we were working in the United States, and I doubt if we are ever able to obtain a smaller rate than this. I am inclined to think that our sanitary work, as far as the sick rate

is concerned, has reached its maximum efficiency, and that all we can expect to do for the future is to hold it up to that rate, though to keep this rate a great deal of work will have to be done.

The good water supply furnished all our employees has kept dysentery from being troublesome, so that I think we can claim that our sanitary work has directly controlled malaria, yellow fever, and dysentery, the three tropical diseases to which we are liable. Bubonic plague is pretty firmly established in some of the Peruvian ports to the south of us, and we have been very anxious on this subject during our occupancy of Panama. In the summer of 1905 two cases of plague occurred at La Boca, the Pacific terminal of the railroad and canal. Both men had been living there for some time and evidently contracted the disease there, but a very careful isolation and disinfection of the town of La Boca, under the supervision of Dr. J. C. Perry, Chief Quarantine Officer, eradicated the disease at this point, and we have had no cases since. Beriberi was quite prevalent on the Isthmus during our first year, but it is now entirely confined to the city of Panama, and much reduced in numbers.

I think, therefore, that the United States authorities can fairly make the following claim for their sanitary work: That when they got control of the Isthmus in May, 1904, the territory along the route of the canal was in its normal condition as to health. It was overgrown by a dense tropical jungle; the natural conditions were everywhere ideal for breeding stegomyia and anopheles mosquitos. The region was inhabited by a considerable population, which was very poor, as the result of the failure of the French canal company and the recent bloody and destructive war which had involved the whole country for some three years. Malaria, dysentery, and

smallpox were prevailing among these people about as they would anywhere in the tropics under similar conditions. Yellow fever infection was present in both Panama and Colon. In fact, the conditions were more favorable for producing a high mortality upon the introduction of a large force than they had been at any time in the past. Into this region the Canal Commission has introduced the largest force ever before present on the Isthmus, some forty thousand persons, ten thousand of whom are white nonimmunes. Yet the sanitary measures taken by the United States during the period of the introduction of this unprecedented force have been such that yellow fever has disappeared, malaria been held in check, and the total sick rate in this force during the month of March, 1907, was only 23 per 1,000.

I think that there can be no reasonable doubt that there is a direct relation of cause and effect between the sanitary measures taken by our Government and the present health conditions on the Isthmus.

ANCON, C. Z.